



DCR1478SY

Phase Control Thyristor

Replaces January 2000 version, DS4646-5.

DS4646-6.0 July 2001

FEATURES

- Double Side Cooling
- High Surge Capability
- High Mean Current
- Fatigue Free

APPLICATIONS

- High Power Drives
- High Voltage Power Supplies
- DC Motor Control

VOLTAGE RATINGS

| Type Number | Repetitive Peak Voltages V_{DRM} V_{RRM} V | Conditions |
|-------------|--|--|
| DCR1478SY48 | 4800 | $T_{vj} = 0^{\circ} \text{ to } 125^{\circ}\text{C}$, $I_{DRM} = I_{RRM} = 250\text{mA}$, $V_{DRM}, V_{RRM} t_p = 10\text{ms}$, $V_{DSM} \text{ \& } V_{RSM} =$ $V_{DRM} \text{ \& } V_{RRM} + 100\text{V}$ respectively |
| DCR1478SY47 | 4700 | |
| DCR1478SY46 | 4600 | |
| DCR1478SY45 | 4500 | |
| DCR1478SY44 | 4400 | |

Lower voltage grades available.

ORDERING INFORMATION

When ordering, select the required part number shown in the Voltage Ratings selection table.

For example:

DCR1478SY48

Note: Please use the complete part number when ordering and quote this number in any future correspondence relating to your order.

KEY PARAMETERS

- V_{DRM} 4800V
- $I_{T(AV)}$ 2073A
- I_{TSM} 27500A
- dV/dt 1000V/ μs
- dI/dt 300A/ μs

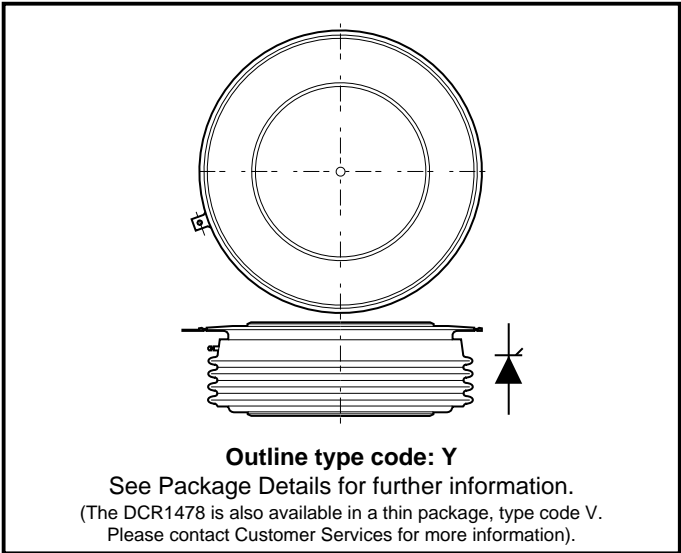


Fig. 1 Package outline

CURRENT RATINGS**T_{case} = 60°C unless stated otherwise.**

| Symbol | Parameter | Conditions | Max. | Units |
|--|--------------------------------------|--|------|-------|
| Double Side Cooled | | | | |
| I _{T(AV)} | Mean on-state current | Half wave resistive load, T _{case} = 80°C | 2073 | A |
| I _{T(RMS)} | RMS value | T _{case} = 80°C | 3257 | A |
| I _T | Continuous (direct) on-state current | T _{case} = 80°C | 2954 | A |
| Single Side Cooled (Anode side) | | | | |
| I _{T(AV)} | Mean on-state current | Half wave resistive load, T _{case} = 80°C | 1340 | A |
| I _{T(RMS)} | RMS value | T _{case} = 80°C | 2105 | A |
| I _T | Continuous (direct) on-state current | T _{case} = 80°C | 1759 | A |

CURRENT RATINGS**T_{case} = 80°C unless stated otherwise.**

| Symbol | Parameter | Conditions | Max. | Units |
|--|--------------------------------------|--|------|-------|
| Double Side Cooled | | | | |
| I _{T(AV)} | Mean on-state current | Half wave resistive load, T _{case} = 80°C | 1625 | A |
| I _{T(RMS)} | RMS value | T _{case} = 80°C | 2550 | A |
| I _T | Continuous (direct) on-state current | T _{case} = 80°C | 2270 | A |
| Single Side Cooled (Anode side) | | | | |
| I _{T(AV)} | Mean on-state current | Half wave resistive load, T _{case} = 80°C | 1050 | A |
| I _{T(RMS)} | RMS value | T _{case} = 80°C | 1650 | A |
| I _T | Continuous (direct) on-state current | T _{case} = 80°C | 1450 | A |

SURGE RATINGS

| Symbol | Parameter | Conditions | Max. | Units |
|-----------|---|---|--------------------|------------------|
| I_{TSM} | Surge (non-repetitive) on-state current | 10ms half sine; $T_{case} = 125^{\circ}C$ | 22.0 | kA |
| I^2t | I^2t for fusing | $V_R = 50\% V_{RRM}$ - 1/4 sine | 2.42×10^6 | A ² s |
| I_{TSM} | Surge (non-repetitive) on-state current | 10ms half sine; $T_{case} = 125^{\circ}C$ | 27.5 | kA |
| I^2t | I^2t for fusing | $V_R = 0$ | 3.78×10^6 | A ² s |

THERMAL AND MECHANICAL DATA

| Symbol | Parameter | Conditions | | Min. | Max. | Units |
|---------------|---------------------------------------|--|-------------|------|--------|---------------|
| $R_{th(j-c)}$ | Thermal resistance - junction to case | Double side cooled | dc | - | 0.0095 | $^{\circ}C/W$ |
| | | Single side cooled | Anode dc | - | 0.019 | $^{\circ}C/W$ |
| | | | Cathode dc | - | 0.019 | $^{\circ}C/W$ |
| $R_{th(c-h)}$ | Thermal resistance - case to heatsink | Clamping force 43.0kN with mounting compound | Double side | - | 0.002 | $^{\circ}C/W$ |
| | | | Single side | - | 0.004 | $^{\circ}C/W$ |
| T_{vj} | Virtual junction temperature | On-state (conducting) | | - | 135 | $^{\circ}C$ |
| | | Reverse (blocking) | | - | 125 | $^{\circ}C$ |
| T_{stg} | Storage temperature range | | | -55 | 125 | $^{\circ}C$ |
| - | Clamping force | | | 38.0 | 47.0 | kN |

DYNAMIC CHARACTERISTICS

| Symbol | Parameter | Conditions | | Typ. | Max. | Units |
|------------------------------------|--|---|-----------------|------|------|-------|
| I _{RRM} /I _{DRM} | Peak reverse and off-state current | At V _{RRM} /V _{DRM} , T _{case} = 125°C | | - | 250 | mA |
| dV/dt | Maximum linear rate of rise of off-state voltage | To 67% V _{DRM} T _j = 125°C. | | - | 1000 | V/μs |
| dI/dt | Rate of rise of on-state current | From 67% V _{DRM} to 1000A Gate source 20V, 10Ω t _r ≤ 0.5μs to 1A, T _j = 125°C | Repetitive 50Hz | - | 100 | A/μs |
| | | | Non-repetitive | - | 300 | A/μs |
| V _{T(TO)} | Threshold voltage | At T _{vj} = 125°C | | - | 1.4 | V |
| r _T | On-state slope resistance | At T _{vj} = 125°C | | - | 0.31 | mΩ |
| t _{gd} | Delay time | V _D = 67% V _{DRM} , Gate source 30V, 15Ω t _r ≤ 0.5μs, T _j = 25°C | | - | 2.5 | μs |
| I _L | Latching current | T _j = 25°C, V _D = 5V | | 300 | 1000 | mA |
| I _H | Holding current | T _j = 25°C, R _{g-k} = ∞ | | - | 500 | mA |
| t _q | Turn-off time | I = 1000A, t = 1ms, T _j = 125°C, V = 50V, dI/dt = 20A/μs, V _{DR} = 67% V _{DRM} , dV _{DR} /dt = 8V/μs linear | | 500 | - | μs |

GATE TRIGGER CHARACTERISTICS AND RATINGS

| Symbol | Parameter | Conditions | Max. | Units |
|-------------|---------------------------|---|------|-------|
| V_{GT} | Gate trigger voltage | $V_{DRM} = 5V$, $T_{case} = 25^{\circ}C$ | 4.0 | V |
| I_{GT} | Gate trigger current | $V_{DRM} = 5V$, $T_{case} = 25^{\circ}C$ | 400 | mA |
| V_{GD} | Gate non-trigger voltage | At V_{DRM} , $T_{case} = 125^{\circ}C$ | 0.25 | V |
| V_{FGM} | Peak forward gate voltage | Anode positive with respect to cathode | 30 | V |
| V_{FGN} | Peak forward gate voltage | Anode negative with respect to cathode | 0.25 | V |
| V_{RGM} | Peak reverse gate voltage | | 5 | V |
| I_{FGM} | Peak forward gate current | Anode positive with respect to cathode | 30 | A |
| P_{GM} | Peak gate power | See table, gate characteristics curve | 150 | W |
| $P_{G(AV)}$ | Mean gate power | | 10 | W |

CURVES

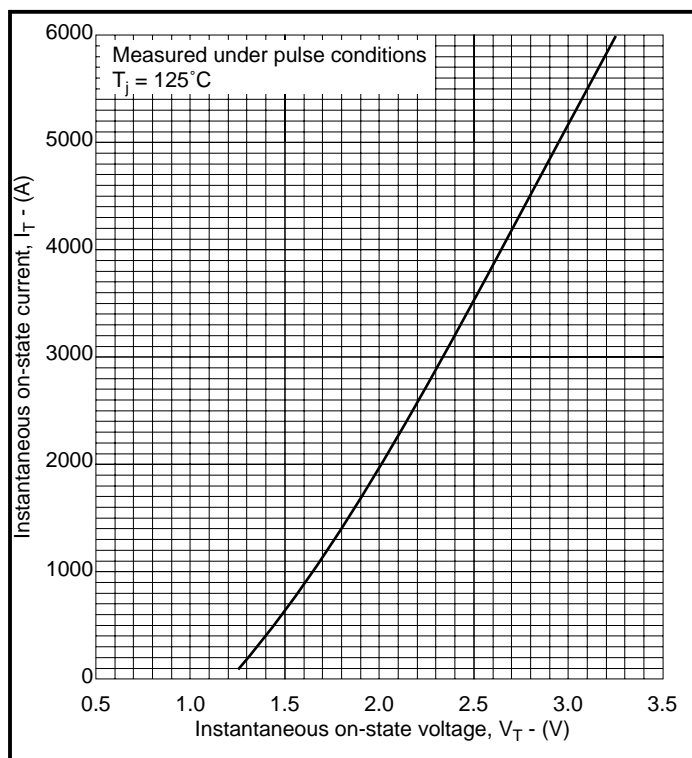


Fig.2 Maximum (limit) on-state characteristics

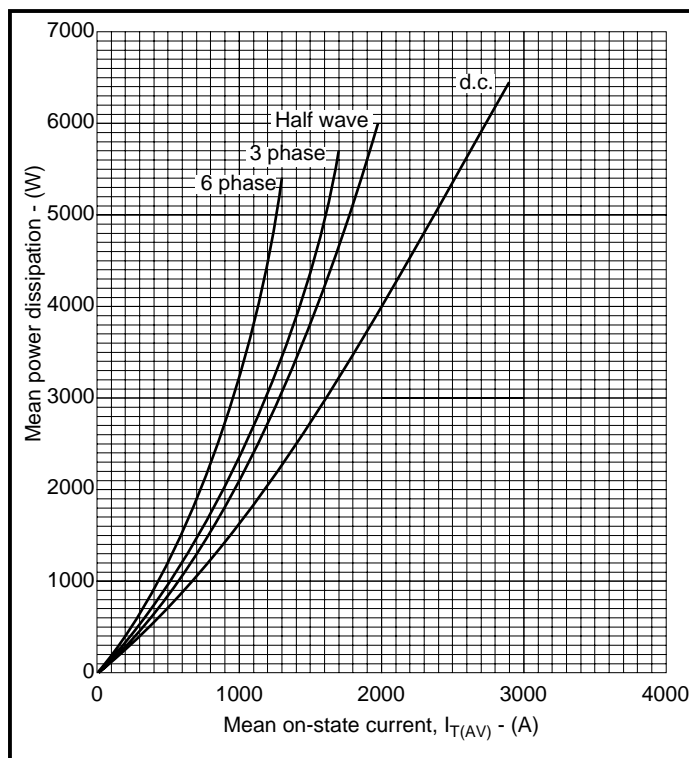


Fig.3 Dissipation curves

V_{TM} Equation:-

$$V_{TM} = A + B \ln(I_T) + C \cdot I_T + D \cdot \sqrt{I_T}$$

Where

$$A = 1.388814$$

$$B = -0.06683276$$

$$C = 2.002455 \times 10^{-4}$$

$$D = 1.589376 \times 10^{-2}$$

these values are valid for $T_j = 125^\circ\text{C}$ for I_T 500A to 6000A

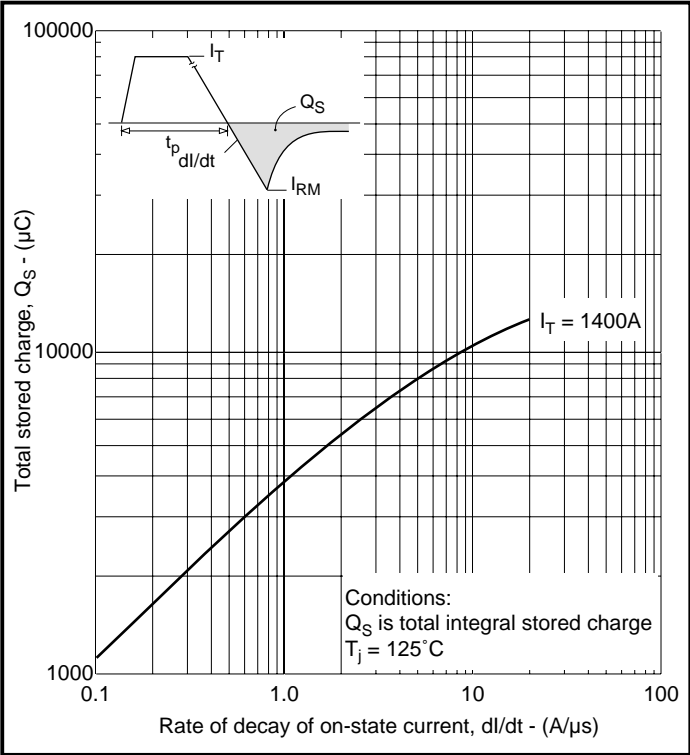


Fig.4 Stored charge

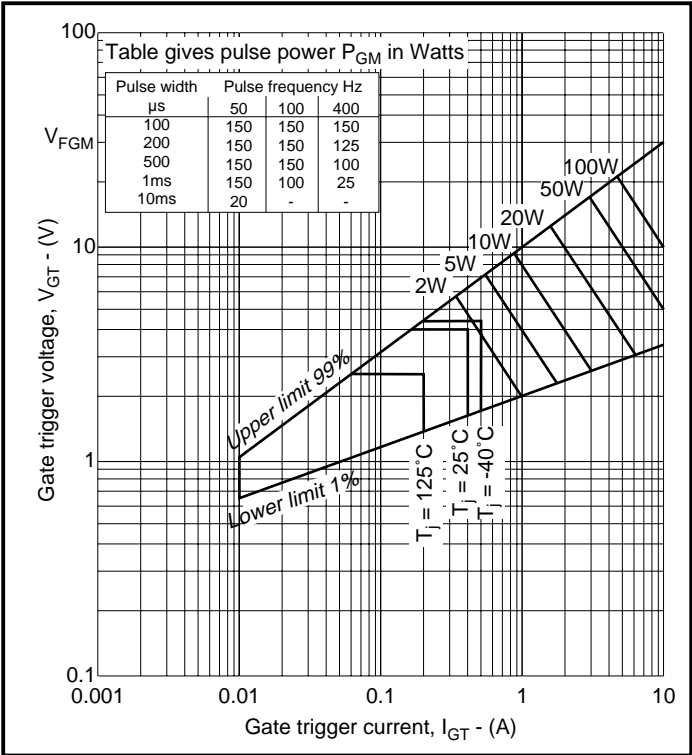


Fig.5 Gate characteristics

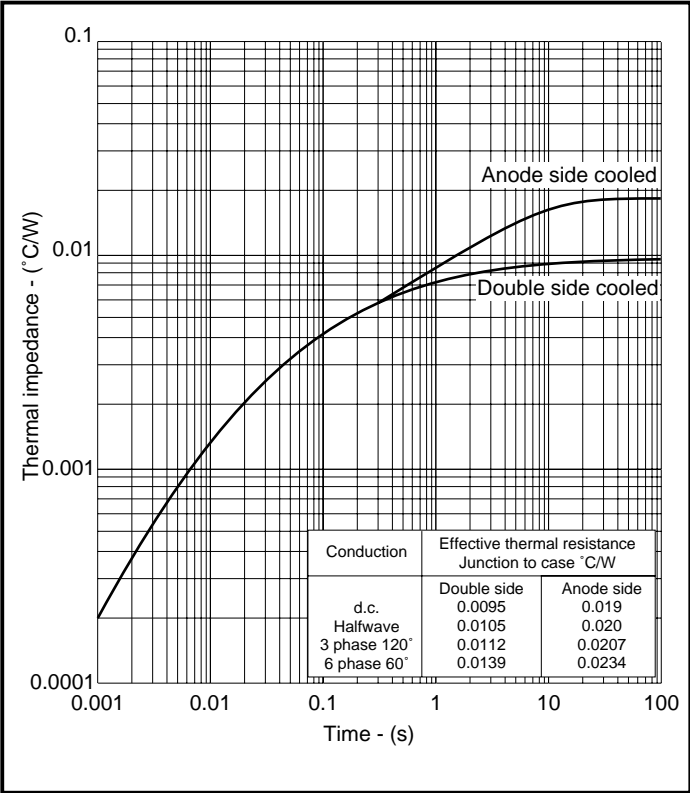


Fig.6 Transient thermal impedance - junction to case

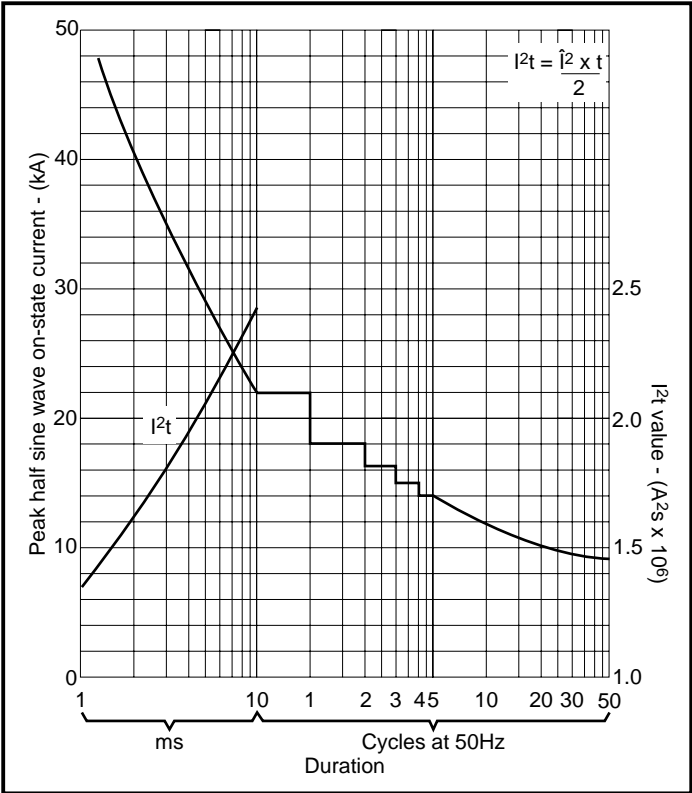
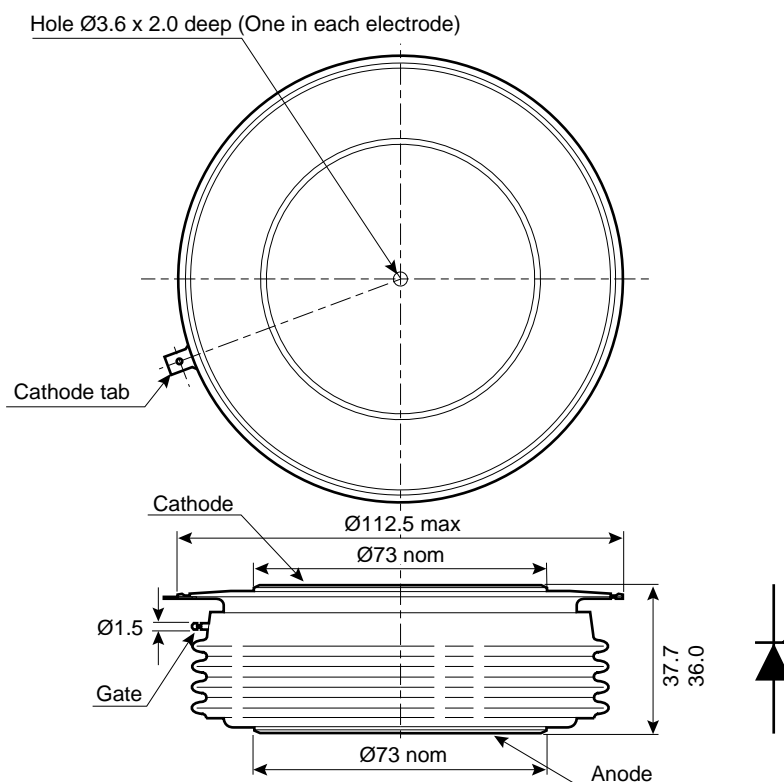


Fig.7 Surge (non-repetitive) on-state current vs time (with 50% V_{RSM} at $T_{case} = 125^\circ C$)

PACKAGE DETAILS

For further package information, please contact your nearest Customer Service Centre. All dimensions in mm, unless stated otherwise.
DO NOT SCALE.



Nominal weight: 1600g
Clamping force: 43kN $\pm 10\%$
Lead length: 420mm
Lead terminal connector: M4 ring

Package outline type code: Y

(The DCR1478 is also available in a thin package, type code V. Please contact Customer Services for more information).

POWER ASSEMBLY CAPABILITY

The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink and clamping systems in line with advances in device voltages and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group continues to offer high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the latest CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete Solution (PACs).

DEVICE CLAMPS

Disc devices require the correct clamping force to ensure their safe operation. The PACS range includes a varied selection of pre-loaded clamps to suit all of our manufactured devices. Types available include cube clamps for single side cooling of 'T' 23mm and 'E' 30mm discs, and bar clamps right up to 83kN for our 'Z' 100mm thyristors and diodes.

Clamps are available for single or double side cooling, with high insulation versions for high voltage assemblies.

Please refer to our application note on device clamping, AN4839

HEATSINKS

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks. They have been designed to optimise the performance of Dynex semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest sales representative or customer service office.



<http://www.dynexsemi.com>

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Target Information: This is the most tentative form of information and represents a very preliminary specification. No actual design work on the product has been started.

Preliminary Information: The product is in design and development. The datasheet represents the product as it is understood but details may change.

Advance Information: The product design is complete and final characterisation for volume production is well in hand.

No Annotation: The product parameters are fixed and the product is available to datasheet specification.

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